Wildlife Working Papers
for
Invasive Species Management Project

A. Effects on Management Indicator Species (MIS)

Effects on four of the MIS for the Forest are included in the biological evaluation for the RFSS and SVC species for this project (BE for RFSS and SVC for NNIS). These include northern bobwhite quail (*Colinus virginianus*), yellow-breasted chat (*Icteria virens*), wood thrush (*Hylocichla mustelina*), and worm-eating warbler (*Helmitheros vermivorus*). The only MIS yet to be analyzed is the scarlet tanager (*Piranga olivacea*).

The scarlet tanager is a common summer resident and migrant on the Forest in the Shawnee Hills and Floodplains (SNF Plan FEIS, Appendix F). The species is generally considered a canopy nesting species and prefers mature oak forests for nesting (Bushman and Therres 1988). They are a common nesting species in upland and bottomland forests in the project areas (Robinson 1996).

Direct effects
Since the species nests in late spring and early summer in the forest canopy, there is little chance that the species could be directly affected by any of the three NNIS alternatives.

Indirect effects
Alternative one would have long term (10-15 years out) indirect effects on the species as invasive plants (IP's) are uncontrolled and would out-compete and replace native overstory and understory plants including native oaks in the upland and bottomland hardwood forest. This would in turn negatively affect nesting habitats, native plant foods and insect prey for the species resulting in declines in populations for the species in the project areas and across the entire Forest.

Alternative three would result in some indirect negative effects similar to indirect effects above for Alternative one as IP's are not totally controlled. This alternative would also have positive effects on upland and bottomland forests in Natural Areas that are burned and would help maintain native plant foods and insect prey for the species. Net indirect effects on the species would probably be no measurable changes in populations in either the short or long term.

Alternative two would have moderate amounts of positive, indirect effects on the species as herbicide applications would control non-native IP's and burning would reduce invasion and replacement by native IP's such as sugar maple in oak-dominated upland and bottomland forests in the project areas. This would result in maintenance and improvement of native plant foods, nesting cover, and insect prey for the species. Net indirect effects would probably be an increase in populations of the species in both the short and long terms.

Cumulative effects
Geographic boundaries for cumulative effects on scarlet tanager would be all HUC-5 watersheds that include project areas on the Forest. Temporal time frames for cumulative effects on the species would be 10-15 years, equivalent to the life of the Forest Plan (2006).

Past actions affecting this species across the Forest are identified in the FEIS for the Plan (SNF FEIS, Chapter 3, 2006). These include agricultural activities and practices including deforestation for agriculture, succession of old fields to early and mid successional hardwood forests, timber harvests

including all types of silvicultural treatments, lack of timber harvest, some mineral exploration and development, prescribed fire especially in the last 5 years and extensive wildfire in the late 19th and early 20th centuries. Present and future actions would include more prescribed fire, up to 12,000 acres per year on the Forest and some smaller amounts on private lands and some smaller amounts of timber harvest and management on both National Forest and adjacent private lands in the project area vicinities.

Alternative one would have no measurable negative or positive direct effects on scarlet tanager as few actions and/or changes to the overall hardwood forests would occur. However, this alternative would have a large, indirect effect, negative effect on native overstory and understory plant species and thus on food and cover for the species. These would also be the cumulative effects on the species. These cumulative effects from Alternative one on habitats and subsequently on populations of scarlet tanager would be more pronounced in the long term (10-15 years out) than in the short term (1-5 years out).

Alternatives 2 and 3 would have no or only minor, negative direct or indirect effects on scarlet tanager. Both alternatives would have relatively, large positive, indirect effects on the species as native overstory and understory plants and/or native prey that depend upon them are maintained or improved in both alternatives with the most improvement and positive effects resulting from Alternative 2 that includes herbicide applications as well as prescribed burning. These would be the cumulative effects on scarlet tanager from Alternatives 2 and 3 except that positive effects on the species would be less pronounced overall as some IP's would persist on adjacent, untreated private land forest habitats adjoining NF and would be even less positive in Alternative 3 as IP's are not totally controlled.

Summary of Effects on MIS of Invasive Species Management Project

There are five MIS for the Forest (FEIS, SNF Plan 2006). These are Northern Bobwhite Quail, Yellow-breasted Chat, Worm-eating Warbler, Wood Thrush, and Scarlet Tanager (BE for RFSS and SVC for NNIS, Wildlife Working Paper for NNIS, 2009). The former four of MIS listed above are Species with Viability Concerns for the Shawnee (BE for RFSS and SVC for NNIS). All of these species occur in all watersheds across the Forest. The above documents (BE for RFSS and SVC and Wildlife Working Papers) for the NNIS analysis include more detailed information and analyses of effects for each species.

Direct and Indirect Effects (MIS)

Generally no direct effects would occur on these species as they would not be present or would be able to move away from planned actions so they would not be directly affected by the hand-pulling, torching, herbicide or burning treatments planned in all alternatives.

All would be indirectly affected by planned actions as follows. Alternative one would have negative, indirect effects on native habitats and abundance and distribution of populations for all as IP's are not controlled or even contained. Alternatives 2 and 3 would have positive, indirect effects on habitats and abundance and distribution of populations for all MIS as native habitats would be improved by burning that maintains or improves native forest overstories and understories and herbicide treatments that control and reduce IP spread and replacement of native species and habitats. Most improvements would result from Alternative 2 that included herbicide treatments.

Cumulative effects (MIS)

Most past and present actions on private lands generally degraded habitats for all the MIS on the Forest. Most recent Forest management actions have improved habitats for all MIS. Future actions on

private lands would continue to degrade habitats for all four MIS however the amount of habitat degradation would be less than historical amounts due to continuation of conservation programs on adjacent private farmlands. Future actions on National Forest lands within the geographic area of the Forest would be more improvement of habitats for all five species primarily through increased prescribed burning in native forests, old fields and grasslands.

These past, present, and future impacts combined with the present actions would result in negative, indirect effects on habitats and small negative effects on populations of MIS from Alternative one as IP's continue to invade and outcompete and replace native overstory and understory plants in their habitats.

Alternative two would result in positive indirect effects and cumulative on habitats and moderate, positive effects and cumulative on populations of MIS as herbicide treatments control and/or stop the spread of IP's on the Forest and subsequent displacement of native overstory and understory plants in hardwood forests, old fields and barrens. Burning as proposed in alternative two would improve native forest, old fields, and barrens habitats for all MIS as native plant species are maintained and improved on 12,000 acres of National Forest.

Alternative three would result in cumulative effects similar to those Alternative 2 except that herbicide control of IP's would be replaced by less effective and extensive controls of IP's resulting in less positive effects on the native, MIS habitats.

Compliance with the Migratory Bird Treaty Act and Executive Order 13186
Four of the five Forest MIS are migratory birds protected by the Migratory Bird Treaty Act. Executive Order 13186, signed on January 10, 2001, among other things, directed all Federal Agencies to "*take certain actions to further implement the Act" (i.e. Migratory Bird Treaty Act). For purposes of this project, the applicable sections of EO13186 are Sec.3.(e) that each agency shall "to the extent permitted by law… and in harmony with agency missions: (1) …avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions*;" and "(6) *ensure that environmental analyses of Federal actions required by the NEPA or other established environmental review processes evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.*"

The Forest has taken, and continues to take, many planning and administrative actions, at both the Forest level and the project-level, to conserve populations of migratory birds across the Forest. The Forest is complying with Executive Order 13186, to the extent practicable to work with the USFWS to conserve populations of migratory birds. The Forest consulted with the US Fish and Wildlife Service on the proposed management of migratory birds (planning record) and received no indication that possible Plan actions do not comply with the Migratory Bird Treaty Act (MBTA) and meet fully the intent of Executive Order 13186. The Forest has historically been a leader in Illinois and the Midwest in management to benefit and conserve many species of migratory birds on the Forest. The 2006 Forest Plan expands (from 1992 Plan acreage) the amount of area on the Forest—99,400 acres—on which management will be emphasized to reduce forest fragmentation and improve forest diversity for migratory birds, especially those that need un-fragmented forest. The 2006 Forest Plan also emphasizes management for both resident and migratory grassland birds with the inclusion of the Large Openlands management prescription and its direction and guidelines.

Standards and guidelines (both at the Forest level and the management prescription level) have been developed in the 2006 Forest Plan to minimize potential direct and indirect adverse effects, and to implement actions to enhance habitat and populations of resident and migratory birds.

The best science available was used to develop the 2006 Forest Plan management strategies and direction for migratory birds, which was developed after consultation with recognized avian scientists. The Forest has been, and is, an active partner in the Central Hardwoods Bird Conservation Region. By participating in Partners in Flight, the Forest is coordinating our efforts with the efforts of many other state, federal, local government, and private conservation agencies to focus bird conservation efforts where they will do the most good. The new Forest Plan employs the latest avian, wildlife, and forestry scientific information and input from these avian scientists. Plan management directions and strategies evolved to serve as countermeasures to identified major threats by insuring forest interior, early-successional forest, and grasslands in the Hoosier-Shawnee ecological assessment area.

Both of the action alternatives proposed and evaluated for this invasive species management project fully incorporate the standards and guidelines outlined in the 2006 Forest Plan to reduce the potential for adverse impacts to migratory birds from implementation of land management actions, and thus comply with the intent of Executive Order 13186 to protect and conserve migratory birds.

Sec. 3.(e)(1) of Executive Order 13186 also directs federal agencies to "*support the conservation intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities…*" Sec 3.(e)(2) further states that federal agencies shall "*restore and enhance the habitat of migratory birds, as practicable.*"

The Forest has worked toward these goals for decades. The 1992 Forest Plan contained standards and guidelines designed to provide a wide variety of forested habitat conditions, as well as special standards and guidelines for protection and management of specialized habitats (wetlands, caves, glades, riparian, bottomland hardwoods, ponds, and shortleaf pine forest) to restore and enhance habitats for a diversity of avian species. The 2006 Forest Plan carried forth many of the essential elements of the 1992 Forest Plan, but with expanded effort directed toward the designation of areas within which habitat conditions would be restored/perpetuated to support interior migratory birds, restore historical open grasslands, and in restoring/ maintaining high quality bottomland hardwood and riparian forest habitat conditions. The standards and guidelines recognize that all successional stages of forest, open habitats, and unique ecological conditions are important components of a healthy ecosystem that will support viable populations of all native species.

B). Effects of Invasive Species Management Project on ground-nesting birds

Ground nesting birds are thought to be more prone to negative effects from herbicide treatments and prescribed burning due to individuals and nests being within the zones of influence for herbicide and prescribed burning utilizing ground fires. Three species of SVC and MIS are ground nesting, bird species and occur in all watersheds on the Forest. These are worm-eating warbler, Northern bobwhite quail, and American woodcock. Effects on these three species would be indicators for effects on ground-nesting bird species in this analysis.

Direct effects (ground-nesting birds)

Alternative one would have no direct effects on ground-nesting bird species as none would be directly affected by hand-pulling or torching as part of IP control actions. These species would be able to avoid applicants of hand-pulling and torching and likewise applicants would be able to avoid known nest sites.

Alternatives two and three would have no direct effects on most ground-nesting species with the exception of the American woodcock that begins nesting very early in the Spring during burning and herbicide treatment periods. There should be no direct effects of herbicide treatment on nests of early ground nesting birds such as the American woodcock as known sites can be avoided by applicants. However, prescribed fire could have negative affects on some American woodcock nests in early Spring. Early Spring burns in early and late March could cause the species to re-nest in another location or similar locations, shortly after burning. Not all American woodcocks would be directly affected in a particular burn area as there would still be some, unaffected nesting habitats within burns as part of burn mosaics

Indirect effects (ground-nesting birds)

Alternative one would have a negative, indirect effect on habitats for most ground-nesting birds as native woody and herbaceous understory vegetation declines in abundance and is replaced by non-native IP's as a result of limited control of IP's. This would result in a loss of nesting cover and native foods for these species.

Alternatives 2 and 3 would have net, beneficial, indirect effects on ground-nesting birds from burning of natural areas (about 12,000 acres) and from herbicide treatments of the worst infestations of IP plants on Forest. Herbicide treatments of IP as planned in Alternative 2 would greatly reduce the spread of IP on National Forest and this should improve the diversity and abundance of native plants in treated areas of hardwood forests, grasslands and old fields. Herbicide treatments in Alternative 2 would reduce the spread and decrease the abundance of IP's and their replacement of native food and cover plants. Native plants that provide the nesting and hiding cover and foods that ground-nesting birds have adapted to and utilize heavily will increase in abundance and diversity. IP treatments as planned in Alternative 3 would not utilize chemical herbicides and would be less effective at controlling and stopping the spread of IP's. Beneficial effects on native plant habitats for ground-nesting birds would be less than those in Alternative two.

Burning of natural areas in both Alternatives 2 and 3 will result in net improvements of both food and cover plants for the ground-nesting species in years following the burns as native herbaceous understory and woody overstory species that are adapted to fire would benefit. Burning in both alternatives will also reduce some nesting cover such as leaf litter for some ground-nesting birds during the year of the burn. Not all ground nesting cover would be affected in every burn area due to the mosaics of burned and unburned created by prescribed fire applications and prescriptions. Overall, prescribed burning on National Forest as part of planned actions in Alternatives 2 and 3 would have measurable, positive effects on habitats (improvement of food and cover) for all ground-nesting, bird species.

Cumulative effects (ground-nesting birds)

Past and present actions on private lands especially home and transportation system developments and farming actions including grazing of forests and grasslands and the clearing of hardwood forests to provide new crop fields adjacent to National Forest in the project areas have usually had negative effects on ground nesting species by elimination of habitats directly or by increasing habitats that benefit the spread of IP's and invasive animals such as the brown-headed cowbird.

Cumulative effects of Alternative one in combination with past and present effects on adjacent private lands would be decline in native habitats with an associated small decline in populations of ground-nesting species as IP's spread and replace native plants/habitats. Cover for nesting and hiding and foods consisting of native plant parts as well as native insects would decline.

Cumulative effects of Alternatives 2 and 3 on ground-nesting birds would be moderate to large improvement of habitats for ground-nesting species in years after application of prescribed fire. Alternative 2 would have more, positive, cumulative effects on habitats for ground-nesting species than Alternative 3 as chemical herbicides would be more effective in controlling and reducing populations of IP's than synthetic herbicides. Populations of ground-nesting birds would be increased albeit more in Alternative two than in three. Negative effects on habitats and individual ground-nesting birds from continued past and present actions on adjacent private lands would dilute the overall, positive effects of management actions on National Forest for ground-nesting birds in both Alternatives.

C.) Effects on Federal T&E and Candidate Species

Table 1. Summary of Effects for Federally Listed and Candidate Species

CLASS	SPECIES	COMMON NAME	STATUS	Alt. 1	Alt. 2	Alt. 3
Mollusk	*Lampsilis abruptus*	pink mucket pearly mussel	Endangered (E)	NE	NLAA	NLAA
Mollusk	*Plethobasus cooperianus*	orange-footed pearlymussel	E	NE	NLAA	NLAA
Mollusk	*Potamilus capax*	fat pocketbook pearlymussel	E	NE	NLAA	NLAA
Mollusk	*Cumberlandia monodota*	spectaclecase	Candidate for Federal listing ©	NE	NLAA	NLAA
Mollusk	*Plethobasus cyphus*	sheepnose	C	NE	NLAA	NLAA
Bird	*Sterna antillarum*	least tern	E	NE	NLAA	NLAA
Mammal	*Myotis sodalis*	Indiana bat	E	NE	NLAA	NLAA
Mammal	*Myotis grisescens*	gray bat	E	NE	NLAA	NLAA
Fish	*Scaphirhynchus albus*	pallid sturgeon	E	NE	NLAA	NLAA
Plant	*Asclepias meadii*	Mead's milkweed	Threatened	NE	NE	NE

NLAA = Not Likely to Adversely Affect
NE = No Effect

NLAA was determined for pallid sturgeon and pink mucket, spectaclecase, and scaleshell mussels because effects are considered insignificant and/or discountable. NLAA was determined for Indiana bat, gray bat because effects are considered beneficial, insignificant, and/or discountable. No effect (NE) determinations were made due to lack of documented occurrences on National Forest lands, the project is outside the known or expected range of the species, and/or design criteria were incorporated into the project proposal and will be implemented to protect the species.

A detailed analysis of the effects on Federal Threatened, Endangered and Candidate Species is found in the Final Biological Evaluation for Federal Species for this project (BE for T&E for NNIS) in this project planning record and part of the wildlife working papers.

According to the local USFWS Ecological Services field office (February 2009-USFWS Region 3, T&E website listing), the following federal threatened, endangered or candidate species have ranges that include the Shawnee National Forest Proclamation Boundary: Endangered- gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), least tern (*Sterna antillarum*), pallid sturgeon (*Scaphirhynchus albus*), fat pocketbook pearlymussel (*Potamilus capax*), pink mucket pearlymussel

(*Lampsilis orbiculata*), orange-footed pearlymussel (*Plethobasus cooperianus*); Threatened- Mead's milkweed (*Asclepias meadii*); Candidate-sheepnose mussel (*Plethobasus cyphyus*) and spetaclecase mussel (*Cumberlandia monodonta*).

Effects on Aquatic Endangered or Candidate Species

Least tern, pallid sturgeon, and the five mussels species listed above will be lumped for this analysis as Aquatic T&E and Candidate Species.

The implementation of the no action, existing condition would have no effect on least tern, fat pocketbook, pink mucket, orange-footed pearlymussel, sheepnose, spectaclecase, and pallid sturgeon since none of the species are known from existing treatment areas and treatments would have little direct or indirect effects on aquatic habitats for these species. The implementation of Alternatives 2-3 may affect but is not likely to adversely affect least tern, fat pocketbook, pink mucket, orange-footed pearlymussel, sheepnose, spectaclecase, and pallid sturgeon. This determination was made primarily because it may be possible for direct or indirect adverse effects to occur to individuals. However, for reasons given below, these effects meet the definition of insignificant and discountable.

Several design criteria related to water quality will be implemented to protect these species from potential adverse impacts of treatments proposed in Alternatives 2 and 3. In particular, only formulations approved for aquatic-use would be applied adjacent to wetlands, lakes, and streams, following label direction. Mixing of these chemicals will be done at least 100 feet away from these areas to prevent spills and concentrated chemicals from entering water occupied by rare species. Exposed soils will be promptly revegetated to avoid re-colonization by IP and to stabilize the soil. Fueling or oiling of mechanical equipment and mechanically constructed firelines for prescribed burning would occur at least 100 feet from aquatic habitats, caves, and mine openings. In addition, effects from herbicide application within the watersheds could occur, but these effects are considered insignificant and discountable given the implementation of Forest Plan standards and guidelines and design criteria, the scattered location of treatments within a watershed, and the relatively small individual sites being treated.

Beneficial effects from the elimination or reduction of IP (as proposed in Alternatives 2 and 3) from adjacent terrestrial habitats would be long term. Protecting aquatic habitats and allowing native vegetation to thrive will also benefit various host species that the five mussels rely upon.

Effects on Indiana and Gray Bats-Federal Endangered Bats

The Forest and project areas contain habitat for both the Indiana and gray bats, both of which are Federal endangered species.

Alternative 1 will have no direct, indirect, or cumulative effect on the Indiana bat or gray bat. Alternatives 2 and 3 may affect but are not likely to adversely affect the Indiana or gray bat. These effects are considered beneficial, insignificant, and discountable. This was determined primarily because smoke could enter caves and fire could burn unknown roost trees. Also, if smoke lingered within the forested areas at dusk when Indiana bats are foraging, it could temporarily displace individuals. The treatment of IP may also be beneficial for the gray and Indiana bat because it will help maintain native habitats and those native insects (prey species) that have evolved with native plants. With the implementation of Standards and Guidelines in the Forest Plan, along with design criteria for Alternatives 2 and 3, both species would be protected from direct and indirect effects. Consequently, actions proposed in Alternatives 1-3 are not expected to have any substantial cumulative effects on either species.

The potential adverse effects associated with prescribed fire are greatly ameliorated through implementation of standards and guidelines for Indiana bats. The following is a list of forest-wide and Indiana bat standards and guidelines applicable to prescribed fire and an explanation of benefits for Indiana bats:

1. *Prohibit any significant disturbance such as prescribed burning and smoke generation and tree cutting, except for bat habitat enhancements, within approximately 100 feet of a cave entrance or open abandoned mine entrance when occupied by bats (Appendix H, p 286).*

2. *FW51.2.1.1 (S) Smoke-management planning is used to control the effects of smoke emissions and meet air-quality standards. During prescribed fires, consideration shall be given to smoke-sensitive areas including Indiana or gray bat hibernacula that may lie downwind of the burn.*

3. *FW51.2.1.2 (S) Burns within 0.25 miles of any Indiana or gray bat hibernacula shall be conducted under conditions that will reduce or eliminate smoke dispersing into the hibernacula.*

Implementation of these standards will significantly reduce the possibility of smoke entering hibernacula and impacting hibernating or roosting Indiana bats.

4. *FW51.2.1.3 (S) To reduce the chances of affecting maternity roosts and foraging habitats, no prescribed burns shall be done in upland forest from 5/1-9/1 and in bottomland forests from 4/1-9/1. No burning shall be done in forested areas of Oakwood Bottoms during the spring seasons, 3/1-4/1 annually. Only 30% (approximately 1,900 acres) of the Big Muddy bottomlands (approximately 6,200 acres of National Forest) east of the Big Muddy levee shall be burned (blackened) annually during spring burning seasons.*

Implementation of these standards will significantly reduce the potential impacts associated with prescribed burns within the home range of maternity colonies. By limiting the timing and amount of prescribed burning within the Oakwood Bottoms and Big Muddy bottomlands, insect populations should not be significantly affected in any given year to such a degree that there will be negative fitness consequences for Indiana bats. As prescribed burns will occur in the spring in uplands, tree-roosting Indiana bats could be adversely impacted. However, these burns will occur early in the maternity season prior to the birth of pups, thus female bats should be able to relocate to other roosting habitats, thus direct mortality is not anticipated. Fall burns after 9/1 could also adversely impact roosting Indiana bats. However, by this time pups will be mobile and should be able to relocate to other roosting habitats, thus direct mortality is not anticipated.

5. *FW51.2.1.4 (S) To reduce the chances of adversely affecting Indiana bat, male roosting habitat within 4km (2.5 miles) of surrounding known hibernacula, no more than 20% of the habitat in this zone shall be burned (blackened) annually. Within 4km-8km (2.5 to 5 miles) surrounding known hibernacula, no more than 50% shall be burned (blackened) annually.*

Implementation of this standard should ensure that insect populations are not significantly depressed around hibernacula in any given year due to prescribed burns. Thus, the fitness of individuals using these areas should not be negatively affected (i.e., insect availability is not expected to be decreased such that the foraging efficiency of those individuals will be decreased). Some burns will occur during the spring and summer which may impact roosting habitat for individuals using this area in the summer. However, these bats are mobile and will be able to locate alternate roost trees readily. Given the small amount of habitat impacted around hibernacula (see analysis in FEIS Appendix F and Appendix B of the Biological Opinion for the SNF Plan) and the relatively small number of individuals exposed, the bats are expected to be able to relocate and fitness consequences are not anticipated. In

the fall, larger numbers of Indiana bats occupy the habitat within and surrounding hibernacula. During this time bats are accumulating fat reserves and continue to roost in trees to some extent. Habitat around hibernacula is abundant in comparison to the number of bats utilizing these hibernacula (Appendix B). Prescribed fire may also benefit Indiana bats in many ways. High intensity fire may create additional snags and potential roost trees for Indiana bats. Opening the understory would reduce clutter around these potential roost trees improving microclimate diversity and foraging conditions. In addition, oak regeneration should occur in response to the fire, leading to long-term potential roosting habitat on the landscape. The benefits would be increased fitness, shortened gestation periods and improved reproductive success. This could ultimately lead to population stability or increase.

Finally, insect abundance in areas has been identified as increasing for some time following prescribed fire, ranging from months to years, (Jackson 2004). While this effect may depend on location and/or time of year, it could lead to higher quality and quantity of the insect base and increased feeding success for Indiana bats. This would lead to an improved energy budget, increased reproductive success and survival, ultimately resulting in population stability or increase.

Mop-up operations include measures to extinguish burning coals and/or trees to preclude fire escape. Burning trees may be felled for this purpose. No additional impacts beyond those discussed above are anticipated as a result of mop-up operations.
Forest Plan standards for the removal of dead live trees during bat maternity seasons would be followed (Forest Plan, Appendix H).

D). Effects on RFSS Animals

Table 1. Summary of Effects on RFSS and SVC Animals (Details in BE for RFSS and SVC).

	Alt. 1	**Alt. 1**	**Alt. 2**	**Alt. 2**	**Alt. 3**	**Alt. 3**
Species	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**
Invertebrates						
Spike	No effect/ No effect	No effect	No effect/May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Carrinate pillsnail	No effect/ May adversely effect	May adversely affect	May affect not likely to aversely affect/beneficial effects	Beneficial effects	May affect not likely to aversely affect/beneficial effects	Beneficial effects
Purple Liliput	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Illinois cave beatle	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
springtail	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Cave obligate	No effect/ No	No effect	No effect/ May	May affect	No effect/ May	May affect

	Alt. 1	Alt. 1	Alt. 2	Alt. 2	Alt. 3	Alt. 3
Species	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**
isopod	effect		affect not likely to aversely affect	not likely to aversely affect	affect not likely to aversely affect	not likely to aversely affect
millipede	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Bousfield's amphipod	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Indiana crayfish	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Big-claw crayfish	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Hubricht's cave flatworm	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Subtle cave amphipod	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Fish						
Bantam sunfish	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Spring cavefish	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Reptiles						
Timber rattlesnake	No effect/ May adversely effect	May adversely affect	May affect not likely to aversely affect/beneficial effects	Beneficial effects	May affect not likely to aversely affect/beneficial effects	Beneficial effects
Alligator snapping turtle	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
	Alt. 1	**Alt. 1**	**Alt. 2**	**Alt. 2**	**Alt. 3**	**Alt. 3**
Species	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**
Northern Copperbelly water snake	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect

Amphibians						
Bird-voiced treefrog	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Gray treefrog	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Birds						
Henslow's sparrow	No effect/No effect	No effect	No effect/No effect	No effect	No effect/No effect	No effect
Cerulean warbler	No effect/May adversely affect	May adversely affect	No effect/May affect, not likely to adversely affect	Beneficial effect	No effect/May affect, not likely to adversely affect	Beneficial effect
Loggerhead shrike	No effect/No effect	No effect	No effect/No effect	No effect	No effect/No effect	No effect
Swainson's warbler	No effect/No Effect	No effect	No effect/No effect	No effect	No effect/No effect	No effect
Bald eagle	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect
Northern bobwhite	No effect/May adversely affect	May adversely affect	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect
Worm-eating warbler	No effect/May adversely affect	May adversely affect	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect
Wood thrush	No effect/May adversely affect	May adversely affect	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect
Yellow breasted chat	No effect/May adversely affect	May adversely affect	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect

	Alt. 1	Alt. 1	Alt. 2	Alt. 2	Alt. 3	Alt. 3
Species	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**	**Direct/Indirect Effects**	**Cumulative Effects**
Red-headed woodpecker	No effect/May adversely affect	May adversely affect	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect
American woodcock	No effect/May adversely affect	May adversely affect	May affect not likely to adversely affect/Beneficial effect	Beneficial effect	May affect not likely to adversely affect/Beneficial effect	Beneficial effect
Mammals						
Rafinesques Big-eared Bat	No effect/ No effect	No effect	No effect/ No effect	No effect	No effect/ No effect	No effect
Southeastern myotis	No effect/ No effect on their cave environments, may adversely affect their foraging habitats	No effect on their cave habitats, may adversely affect their foraging habitats	No effect/Beneficial effect	Beneficial effect	No effect/Beneficial effect	Beneficial effect
Eastern small-footed bat	No effect/ No effect on their cave habitats, may adversely affect their cliff roosting habitats	May adversely affect their cliff roosting habitats	May affect not likely to adversely affect/No effect	May affect not likely to adversely affect	May affect not likely to adversely affect/No effect	May affect not likely to adversely affect
Eastern woodrat	No effect/ May adversely effect	May adversely affect	May affect not likely to aversely affect/beneficial effects	Beneficial effects	May affect not likely to aversely affect/beneficial effects	Beneficial effects
Northern river otter	No effect/ No effect	No effect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect	No effect/ May affect not likely to aversely affect	May affect not likely to aversely affect

Aquatic RFSS and SVC

Included in this grouping are totally aquatic species that live most or all of their life cycle in perennial, fresh-water habitats and are known or suspected from specific project areas or within the project area vicinities. Prey for most of these species is also primarily, aquatic species. Aquatic RFSS and SVC for this analysis area include 2 mussels, Spike and Purple Liliput; 2 fish, Spring Cavefish and Bantam Sunfish; 2 reptiles, Alligator Snapping Turtle and Northern Copperbelly Watersnake; 2 amphibians, Bird-voiced treefrog and gray treefrog; 1 bird, bald eagle; and 1 mammal, Northern River Otter. The bald eagle, gray treefrog, and spring cavefish will also be included and discussed associated with other habitat groupings below. The bald eagle forages primarily in aquatic environments and much of its prey base are aquatic animals but it builds its nest in bottomland and upland hardwood forests near aquatic environments. The gray treefrog breeds in aquatic environments, primarily ephemeral pools but lives most of its life in trees in upland and bottomland hardwood forests. Spring cavefish spends much of its life cycle in spring runs, perennial streams, and swamps, but also in aquatic habitats underground in a number of cave systems.

The implementation of the no action, existing condition would have no effect on spike, purple lilliput, spring cavefish, bantam sunfish, alligator snapping turtle, northern copperbelly watersnake, bird-voiced treefrog, gray treefrog, bald eagle and river otter since some of the species are not known from existing treatment areas and/or treatments would have little direct or indirect effects on aquatic habitats for these species. The implementation of Alternatives 2-3 may affect but is not likely to adversely affect spike, purple lilliput, spring cavefish, bantam sunfish, alligator snapping turtle, northern copperbelly watersnake, bird-voiced treefrog, gray treefrog, bald eagle and river otter. This is because it may be possible for direct or indirect adverse effects to occur to individuals. However, for reasons given below, these effects meet the definition of insignificant and discountable.

Several design criteria related to water quality will be implemented to protect these species from potential adverse impacts of treatments proposed in Alternatives 2 and 3. In particular, only formulations approved for aquatic-use would be applied adjacent to wetlands, lakes, and streams and rivers following label direction. Mixing of these chemicals will be done at least 100 feet away from these areas to prevent spills and concentrated chemicals from entering water occupied by rare species. Exposed soils will be promptly re-vegetated to avoid re-colonization by IP and to stabilize the soil. Fueling or oiling of mechanical equipment and mechanically constructed fire lines for prescribed burning would occur at least 100 feet from aquatic habitats, caves, and mine openings. In addition, effects from herbicide application within the watersheds could occur, but these effects are considered insignificant and discountable given the implementation of Forest Plan standards and guidelines and design criteria, the scattered location of treatments within a watershed, and the relatively small individual sites being treated.

The proposed actions of alternatives 2 and3 may cumulatively contribute to environmental impacts such as erosion and water quality. However, these effects would be minor and would not add measurably to the existing effects on aquatic habitats and associated species. Beneficial effects from the elimination or reduction of IP (as proposed in Alternatives 2 and 3) from adjacent terrestrial habitats would be long term. Protecting aquatic habitats and allowing native vegetation to thrive will also benefit various prey and/or host species for the all or some of the ten aquatic RFSS and SVC animal species.

Cave Obligate RFSS and SVC

Included in this grouping are animals that live most or all of their life cycle in subterranean environments in caves or mines. These include Illinois cave beatle, springtail, cave obligate ispopod, millipede (*E. remmingtoni),* Hubricht's cave flatworm, subtle cave amphipod, spring cavefish, eastern small-footed bat, Rafinesques's big-eared bat and Southeastern myotis. The spring cavefish is also included and discussed in the aquatic species grouping for RFSS and SVC above, Rafinesque's big-eared bat is also included in the upland and bottomland dependent RFSS and SVC below, eastern small-footed bat is also included in the cliff dependent RFSS below, and southeastern myotis is also included in the upland and bottomland dependent RFSS and SVC below.

The indirect effects of farming and human development actions on adjacent private lands within the project geographic boundaries and their associated herbicide, fertilizer, and sediment runoffs would continue to have the most pronounced and measurable effects on cave systems and their species in the project areas. This is because of effects of the relatively large amounts of actions and subsequent runoffs of these pollutants on aquatic systems that directly and indirectly affect known and unknown cave systems in the project area. Alternative 1 would have no direct or indirect effects and thus no cumulative effects on cave obligate RFSS and SVC species.

Sedimentation due to burning and herbicide runoffs from planned actions in Alternatives 2 and 3 would not add measurably to the existing effects on cave systems from private lands identified above especially with applications of Forest Plan standards and guidelines and project design criteria. Cumulative effects of these two alternatives would be small and immeasurable on habitat for and populations of cave obligate RFSS and SVC.

Grassland Dependent RFSS and SVC

Included in this grouping are animals that live most or all of their life cycle in grassland, old field, and barrens habitats. These include Henslow's sparrow, loggerhead shrike and northern bobwhite.

Henslow's sparrow and loggerhead shrike are only known on the Forest from existing, large openlands on the Hidden Springs RD, however known and unknown suitable habitat may be bisected by road and stream corridor treatments.

The Northern bobwhite quail is found in old fields and grasslands throughout the project area vicinities on Forest, state, and private lands in all of the HUC5 watersheds on the Forest. It is not only a SVC species but it is also a management indicator species for the SNF.

The indirect effects of farming and human development actions on adjacent private lands within the project geographic boundaries and their associated overall, negative impacts on nesting and feeding habitats and escape cover for henslow's, loggerhead shrikes, and bobwhites would continue to have pronounced effects on the species. Large negative effects on these grassland/old field species have occurred and will continue to occur from the agricultural use of monocultures of non-native perennial grasses such as fescue for pasture, from farming actions that eliminate waste/odd areas dominated by native, herbaceous weeds; from the maturation of historical old fields, and/or from the loss of old fields and native grasslands to development and agriculture; all of which greatly reduces food and cover. Prescribed burning on National Forest as part of planned actions in Alternatives 2 and 3 would have measurable, positive effects on habitats (improvement of food and cover) for bobwhites but a much smaller, incremental positive effect on populations of bobwhites due to the much larger negative effects on the bobwhite populations from management of adjacent private lands. Prescribed burning in the planned project areas would have no effect on henslow's sparrow and loggerhead shrike because they do not occur in the project areas , however, herbicide treatments of IP would greatly reduce the spread of IP on National Forest and this should improve treated areas and grasslands and old fields nearby by reducing the spread of IP and replacement of native food and cover plants.

Cumulative effect of Alternatives 2 and 3 on henslow's sparrow and loggerhead shrike would be maintenance of current suitable food and cover by controlling the potential spread of IP (via controlling pathways of invasion) onto suitable grassland habitats, resulting in no effect of the known populations of these species. Current populations should be maintained on the Forest.

Cumulative effects of Alternatives 2 and 3 on the northern bobwhite would be moderate, overall improvements of food and cover for the species resulting in minor, overall improvements in populations for the species.

Cliff Dependent RFSS and SVC

Included in this grouping are animals that live most or all of their life cycle associated with cliff habitats. These include eastern small-footed bat, eastern woodrat, timber rattlesnake and carinate pillsnail.

Alternative one would not have any direct effects on any of the cliff dependent RFSS as no actions beyond pulling and spot torching of IP's would occur. These actions could affect the carinate pillsnail if they occurred in known habitats. To date they have not occurred in known habitats for this species. Indirect negative effects could occur to all the above, RFSS cliff species from Alternative 1 as their habitats would change as IP are not adequately controlled.

Alternatives 2 and 3 could have some negative, direct effects on all of the above species from burning and/or ingestion of herbicides or natural weed killers in some of the project areas. However design criteria would alleviate most of these negative effects by avoiding key, known habitats for all four species. Burning in both alternatives 2 and 3 would have indirect, positive effects on habitats for the timber rattlesnake and eastern woodrats as dry, upland forests and barrens in association with cliff habitats are maintained and/or improved and thus food and/or cover for both would be improved. Herbicide application, associated with large scale control of IP would have a positive, indirect effect on habitat for carinate pillsnail, eastern woodrat, and timber rattlesnake as native plants would prosper as IP would diminish in the vicinity of cliff habitats and provide additional or continued food and cover for all three species.

Cumulative effects for the carinate pillsnail for Alternative 1 would be long term, negative effects on its habitat as native cliff plant species are replaced by IP's, primarily garlic mustard without implementation of chemical control measures. Alternative 1 would result in negative cumulative effects on populations of the carinate pillsnail as habitat declines in diversity and quality. Cumulative effects for the carinate pillsnail for Alternatives 2 and 3 would be positive effects as known cliff habitats dominated by native plants are protected by controlling IP's and improving overall, native plant diversity. Alternatives 2 and 3 would maintain current populations of the species in known cliff locations.

Cumulative effects of Alternative 1 for the eastern woodrat and timber rattlesnake would be short and long term, negative effects on their habitats as native cliff and dry, upland forest habitats are replaced by IP's including successional changes to maple dominated forests without fire disturbances as well as invasion by garlic mustard and other non-native IP's. Cumulative effects of Alternatives 2 and 3 on the eastern woodrat and timber rattlesnake would be positive effects on habitats dominated by native plants on cliffs and in adjacent, diverse, dry upland forests. Cumulative effects on populations of woodrats and rattlesnakes would also be positive following improvement and maintenance of native habitats.

Alternative one would have no effect and therefore no cumulative effects on eastern small-footed bats. Alternatives 2 and 3 would have no cumulative effects on the eastern small-footed bat with implementation of design criteria protecting cliff areas and caves from any, direct negative effects from prescribed burning on the species. Known and unknown populations of eastern small-footed bats should be maintained on the Forest.

Upland and Bottomland Hardwood Dependent RFSS and SVC

Included in this grouping are animals that live most or all of their life cycle in upland or bottomland hardwood forest habitats. These include cerulean warbler, Swainson's warbler, bald eagle, Rafinesque's big-eared bat, southeastern myotis, eastern woodrat, timber rattlesnake, gray treefrog, worm-eating warbler, wood thrush, yellow-breasted chat, red-headed woodpecker and American woodcock.

Alternative one would have no measurable negative or positive direct effects on any of the other upland and bottomland hardwood dependent RFSS and SVC species listed above as few actions and/or changes to the overall hardwood forests would occur. However, this alternative would have a large, indirect effect, negative effect on native overstory and understory plant species and thus on food and cover for most of upland and hardwood forest dependent species listed above. These would also be the cumulative effects on these species. These cumulative effects from Alternative one on habitats and subsequently on populations of upland and bottomland hardwood dependent, RFSS and SVC would be more pronounced in the long term (10-15 years out) than in the short term (1-5 years out).

Alternatives 2 and 3 would have no or only minor, negative direct or indirect effects on forest dependent RFSS and SVC. Both alternatives would have relatively, large positive, indirect effects on forest dependent RFSS and SVC as native overstory and understory plants and/or native prey that depend upon them are maintained or improved in both alternatives with the most improvement and positive effects resulting from Alternative 2 that includes herbicide applications as well as prescribed burning. These would be the cumulative effects on these species from Alternatives 2 and 3 except that positive effects on all species would be less pronounced overall as some IP's would persist on adjacent, untreated private land forest habitats adjoining NF and would be even less positive in Alternative 3 as IP's are not totally controlled.